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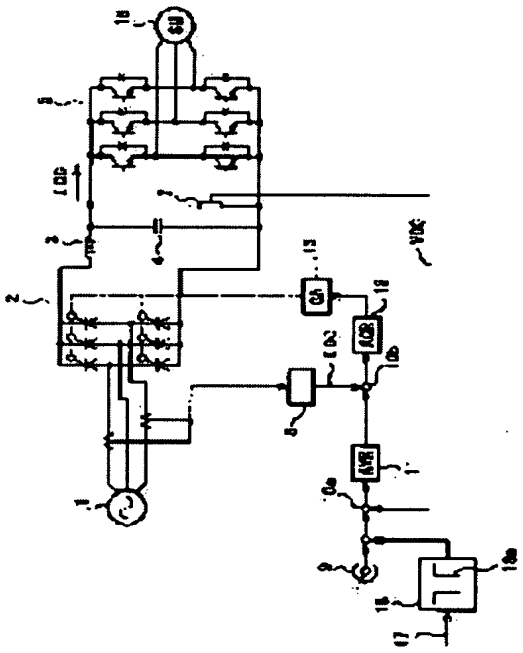
(54) VOLTAGE CONTROL APPARATUS OF POWER CONVERTING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce delay of a control system and suppress voltage variation to smoothly operate a load by receiving an external signal and controlling for a constant period a voltage of a power converter depending on a voltage command pattern outputted from a voltage command pattern output means.

SOLUTION: Upon reception of an external signal 7, a voltage command pattern output means 18 adds a voltage command pattern 18a including voltage and time to a voltage setting value of a voltage setting device 9. A pattern 18a outputted from the voltage command pattern output means 18 reduces a DC voltage during the period indicated in the voltage command pattern 18a. A pattern width outputted from the voltage command pattern output means 18 is set corresponding to the time where a load variation is generated. Therefore, when influence of sudden change of load is eliminated, a DC voltage also becomes constant. A shape of pattern of this voltage command pattern 18a is determined through the simulation of circuit and trial use in the actual plant.



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CLAIMS

[Claim(s)]
[Claim 1] The armature-voltage-control equipment of the power converter characterized by to carry out the fixed period control of the output voltage of said power converter with the electrical-potential-difference command pattern which is equipped with the inverter circuit used as AC power supply, the power converter which inputs said AC power supply and generates direct current voltage, the armature-voltage-control machine which controls said power converter, and the load of said power converter, and an electrical-potential-difference command pattern output means, and is outputted from said electrical-potential-difference command pattern output means in response to the signal from the outside.
[Claim 2] Armature-voltage control equipment of the power converter according to claim 1 characterized by an electrical-potential-difference command pattern being the configuration which carries out a fixed period fall of the output voltage of a power converter.
[Claim 3] It is armature-voltage control equipment of the power converter according to claim 1 which an electrical-potential-difference command pattern reduces the output voltage of a power converter greatly at a period with the beginning, and is characterized by being the configuration which makes a changed part small after that.
[Claim 4] Armature-voltage control equipment of the power converter according to claim 1 characterized by an electrical-potential-difference command pattern being the configuration which carries out a fixed period rise of the output voltage of a power converter.
[Claim 5] It is armature-voltage control equipment of the power converter according to claim 1 which an electrical-potential-difference command pattern raises the output voltage of a power converter greatly at a period with the beginning, and is characterized by being the configuration which makes a changed part small after that.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the armature-voltage control equipment of the power converter which performs load compensation by the side of the PWM converter which is the input power of the inverter circuit which drives a synchronous motor.
[0002]
[Description of the Prior Art] Drawing 5 is the control-block Fig. showing the armature-voltage control equipment of the conventional power converter shown in JP,7-288980,A. drawing -- setting -- 1 -- AC power supply and 2 -- a power converter and 3 -- a reactor and 4 -- a capacitor and 5 -- an inverter circuit and 6 -- an induction motor and 7 -- an electrical-potential-difference detector and 8 -- a current detector and 9 -- for an armature-voltage control machine and 12, as for a gate control machine and 14, a current limiter and 13 are [an electrical-potential-difference setter, and 10a, 10b and 10c / an adder subtracter and 11 / a current detector and 15] load compensation machines.
[0003] A power converter 2 changes AC power supply 1 into DC power supply, and serves as a supply power source of an inverter circuit 5. Moreover, when absorption of the power by the side of a load, i.e., the power of an inverter circuit 5, is needed, a power converter 2 changes the power from this load side, and has the function of that regeneration power of control. A reactor 3 and a capacitor 4 play the role which offers the DC power supply which carried out smooth [of the part for the pulsating flow of the output of a power converter 2]. An inverter circuit 5 changes a direct current into the three-phase-alternating-current power source of an adjustable electrical potential difference and a variable frequency, and drives a motor 6.
[0004] The electrical-potential-difference detector 7 obtains the output voltage VDC for controlling the supply voltage to an inverter circuit 5. IDC is the output current. Moreover, the current detector 8 obtains the input current IAC of a power converter 2. Now, a difference with output voltage VDC is acquired to the electrical-potential-difference set point by the electrical-potential-difference setter 9 in adder subtracter 10a, the control command of the armature-voltage control machine 11 is given from adder subtracter 10a, and a current control command is outputted from the armature-voltage control machine 11.
[0005] And that the input current IAC of the output of the current detector 8 should be controlled, a difference with the current control command of the output of the armature-voltage control machine 11 is acquired in adder subtracter 10b, the output of this adder subtracter 10b is given as a control command of a current limiter 12, and, therefore, current control is performed by the gate control of the thyristor which is the solid state switch of a power converter 2 through the gate control machine 13.
[0006] The current detector 14 detects the DC-power-supply current of an inverter circuit 2, and carries out the signal output of the output current IDC at the load compensation machine 15. The output of this load compensation machine 15 is given as one input of adder subtracter 10c, and the output of the armature-voltage control machine 11 is given to adder subtracter 10c like previous statement as other inputs. Furthermore, the output of adder subtracter 10c is given to adder subtracter 10b. If the load of a motor 6 is changed, the current of the DC power supply of an inverter circuit 5 will be changed, and an electrical potential difference will be changed. In order to reduce fluctuation of the electrical potential difference, it is controlled so that the armature-voltage control machine 11 operates and output voltage VDC becomes fixed. And by catching fluctuation of the input current of an inverter circuit 2 in the functional relation in the load compensation machine 15, and applying the compensation output to the control command of a current limiter 12 for compensation, the control response to the load effect in armature-voltage control is improved, and voltage variation is reduced so that a control response can be more quickly obtained to sudden change of the load of a motor 6.
[0007]

[Problem(s) to be Solved by the Invention] However, since the above configurations were taken and the armature-voltage control machine 11 and the current limiter 12 are operating after that after the electrical-potential-difference detector 7 and the current detector 14 detect the load effect of a motor 6, the delay of a control system arises, and direct-current-voltage fluctuation occurs, as a result a motor suspends the armature-voltage control equipment of the conventional power converter.
[0008] This phenomenon that is not desirable is explained further in full detail. Usually, drive control of this kind of motors is performed based on the signal command from the central control unit of every [which is not illustrated] exception. This central control unit predicts the load of a motor 6, for example, takes out with failure of an inverter or a load the command which performs an instant halt to an inverter circuit 5. Although an inverter circuit 5 performs an instant halt in response to this command, when the energy which flows from a converter 2 then is charged by the capacitor 4, direct current voltage rises. Moreover, for example, the power of a motor 6 becomes large, and when the energy which flows from a converter 2 does not catch up with the case which a load increases rapidly, the stored energy of a capacitor 4 will be consumed in it, and the phenomenon in which direct current voltage falls occurs in it. Such big voltage variation makes troubles, such as overcurrent generating by torque fluctuation of a motor 6, breakage of the driver element of an inverter circuit 5, and the commutation failure at the time of power regeneration, generated. However, with the armature-voltage control equipment of JP,7-288980,A shown by drawing 5 , since it was the delay of a control system when a rapid load effect occurs, it was not able to respond.
[0009] Even when it is made in order that this invention may solve many above troubles, and there is sudden change of an inverter load, delay of a control system is lessened, and voltage variation is pressed down and it aims at obtaining the armature-voltage control equipment which can operate a load smoothly.
[0010]
[Means for Solving the Problem] The armature-voltage-control equipment of the power converter concerning this invention is equipped with the inverter circuit used as the power converter which makes an alternating current direct current voltage, the armature-voltage control machine which controls this power converter, and the load of a power converter, and an electrical-potential-difference command pattern output means, and carries out fixed period control of the electrical potential difference of a power converter in response to the signal from the outside with the electrical-potential-difference command pattern outputted from said electrical-potential-difference command pattern output means.
[0011] Moreover, an electrical-potential-difference command pattern is equipped with the configuration which carries out a fixed period fall of the electrical potential difference of a power converter.
[0012] Furthermore, an electrical-potential-difference command pattern reduces the electrical potential difference of a power converter greatly at a period with the beginning, and it has after that the configuration which makes a changed part small.
[0013] Moreover, an electrical-potential-difference command pattern is equipped with the configuration which carries out a fixed period rise of the electrical potential difference of a power converter.
[0014] Furthermore, an electrical-potential-difference command pattern raises the electrical potential difference of a power converter greatly at a period with the beginning, and it has after that the configuration which makes a changed part small.
[0015]
[Embodiment of the Invention] The gestalt 1 of implementation of this invention is explained based on drawing 1 below gestalt 1. of operation. In drawing 1 , for AC power supply and 2, as for an inverter circuit and 11, a power converter and 5 are [1 / an armature-voltage control machine and 16] synchronous motors, and things other than these and explanation are the same as that of what was shown in drawing 5 of the conventional example. 17 is an external signal and is the signal of foreknowing sudden change of the load which was prepared in another part which is not illustrated and which is emitted, for example from the central control unit of plant control room, and making an inverter circuit 5 halt etc. 18 is an electrical-potential-difference command pattern output means outputted when an external signal is received.
[0016] Now, if the signal of load sudden change like an instant halt is outputted to an inverter circuit 5 from the central control unit which is not illustrated, as the conventional example explained, direct current voltage tends to rise. However, with the armature-voltage control equipment shown in the gestalt 1 of this operation, when an external signal 17 is received, an electrical-potential-difference command pattern including an electrical-potential-difference value and time amount as shown with the electrical-potential-difference command pattern output means 18-18a is added to the electrical-potential-difference set point of the electrical-potential-difference setter 9. Since pattern 18a outputted from the electrical-potential-difference command pattern output means 18 shown in drawing 1 is a configuration value which carries out a fixed period fall of the electrical potential difference, it becomes the same as that of the electrical-potential-

difference set point having fallen for a control system, and the period and control system which are shown in electrical-potential-difference command pattern 18a reduce direct current voltage, and are committed as like. Direct current voltage serves as a wave on which the sag of the control-system actuation by inputting pattern 18a of the electrical-potential-difference command pattern output means 18 as the direct-current-voltage rise by load sudden change was made to superimpose. Since the load effect as which the halt command to an inverter circuit 5 is inputted is temporary, the pattern width of face outputted from the electrical-potential-difference command pattern output means 18 is set up corresponding to the time amount which a load effect generates. So, since the electrical-potential-difference command value of electrical-potential-difference command pattern 18a is also set to 0 when the effect of load sudden change is lost, it becomes fixed [direct current voltage]. The pattern configuration of this electrical-potential-difference command pattern 18a tries, and is determined in the simulation of a circuit, and an actual plant. Thus, by adding output pattern 18a from the electrical-potential-difference command pattern output means 18 to the electrical-potential-difference set point of the electrical-potential-difference setter 9, when the external signal 17 which foreknew sudden change of a load is received, while preventing the overvoltage of equipment, it becomes possible to prevent a halt of a motor.

[0017] The gestalt 2 of implementation of this invention is explained based on drawing 2 below gestalt 2. of operation. Although output pattern 18a from the electrical-potential-difference command pattern output means 18 stated a configuration in which a fixed electrical potential difference is reduced to fixed time amount with the gestalt 1 of the above-mentioned operation, in sudden change of a load, the rise of big direct current voltage in early stages is generated in many cases. The gestalt 2 of this operation is invented that it should be coped with when such a situation occurs. Output pattern 19a from an electrical-potential-difference command pattern output means 19 by which an external signal 17 is shown in drawing 2 immediately after reception is added to the electrical-potential-difference set point of the electrical-potential-difference setter 9. This electrical-potential-difference command pattern 19a enlarges a fallen part of an electrical-potential-difference value within a period with the beginning, presses down a steep power surge, and in a part with little effect of load sudden change, it becomes possible to make small a changed part of electrical-potential-difference command pattern 19a, and to set direct current voltage constant, and it is [controls voltage variation more and] effective in the ability to maintain smooth operation of a load.

[0018] The gestalt 3 of implementation of this invention is explained based on drawing 3 below gestalt 3. of operation. The gestalten 1 and 2 of the above-mentioned implementation described the case where sudden change of a load stopped a motor 6. A safe cure against operation of equipment is desired also to the fall of direct current voltage when the stopped motor 6 starts suddenly on the other hand. As starting with a sudden motor 6 was already described, direct current voltage falls, the direct-current low-battery detector which is not illustrated operates, and equipment results in a halt. The gestalt 3 of this operation is invented corresponding to such a situation. The external signal 17 shown in drawing 3 adds output pattern 20a from an electrical-potential-difference command pattern 20 output means to the electrical-potential-difference set point of the electrical-potential-difference setter 9, when it is equivalent to the seizing signal of load sudden change and an equipment side receives this external signal 17. By this add lump, for a control system, it becomes the same as that of the electrical-potential-difference set point having gone up, and a control system raises direct current voltage temporarily, and is committed as like. Consequently, direct current voltage serves as a direct-current-voltage fall by load sudden change, and a wave on which the power surge by the control system by the input of pattern 20a of the electrical-potential-difference command pattern output means 20 was made to superimpose. The pattern width of face of electrical-potential-difference command pattern 20a is set as the time amount which the direct current voltage corresponding to the load sudden change at the time of starting of a motor 6 generates. So, when the effect of load sudden change is lost, the electrical-potential-difference command value of electrical-potential-difference command pattern 20a is also 0, and becomes fixed [direct current voltage]. Thus, when an external signal 17 is received, by adding electrical-potential-difference command pattern 20a to the electrical-potential-difference set point, it becomes possible to carry out direct current voltage to beyond the set point of a low-battery detector, and smooth starting operation of a load is performed.

[0019] The gestalt 4 of implementation of this invention is explained about drawing 4 below gestalt 4. of operation. Although electrical-potential-difference command pattern 20a stated a configuration which raises a fixed electrical potential difference to fixed time amount with the gestalt 3 of the above-mentioned operation, in the load sudden change at the time of starting, the fall of big direct current voltage in early stages is generated in many cases. The gestalt 4 of this operation is invented corresponding to such a case. Electrical-potential-difference command pattern 21a from an electrical-potential-difference command pattern output means 21 by which an external signal 17 is shown in drawing 4 immediately after reception is

added to the electrical-potential-difference set point of the electrical-potential-difference setter 9. Within a period with the beginning after external signal 17 reception, this electrical-potential-difference command pattern 21a can control voltage variation more while it becomes possible [seting direct current voltage constant, when a gone up part of an electrical-potential-difference value is enlarged, steep sag is pressed down and the effect of subsequent load sudden change makes a part for that change small in few parts] and can perform smooth starting of a load.

[0020] Although the source of fluctuation generating of direct current voltage explained with the gestalten 1-4 of this operation as mentioned above as what is depended on the rapid load effect of a synchronous motor 6, even if it is not necessarily based on a synchronous motor 6 and is intense equipment of other load effects, it cannot be overemphasized that this invention is applicable. Moreover, two or more electrical-potential-difference command patterns corresponding to the load effect generating is expected to be in the plant may be made to build in, and you may make it output according to an external signal in an electrical-potential-difference command pattern output means.

[0021]

[Effect of the Invention] Since this invention is constituted as explained above, it does effectiveness as taken below so.

[0022] Since an electrical-potential-difference command pattern output means outputs the electrical-potential-difference command pattern which carries out fixed period control of the output voltage of a power converter in response to the signal from the outside, the breakage of the starting component of an inverter circuit with little torque fluctuation of a motor with little [consequently] voltage variation with little delay of a control system and armature-voltage control equipment with few overcurrent generating troubles can be offered.

[0023] Furthermore, since it has the electrical-potential-difference command pattern which carries out a fixed period fall of the output voltage of a power converter, even if it faces a rapid load effect, a power surge can be prevented and armature-voltage control equipment with little voltage variation can be offered.

[0024] furthermore, the period which has the beginning in the output voltage of a power converter -- it is made to fall greatly, and since it has after that the electrical-potential-difference command pattern which makes a changed part small, the power control unit which controlled the big power surge in early stages of a load effect can be offered.

[0025] Furthermore, since it has the electrical-potential-difference command pattern which carries out a fixed period rise of the output voltage of a power converter, even if it faces the big load effects at the time of starting etc., sag is prevented, a load can be started smoothly and a power control unit with little voltage variation can be offered.

[0026] the period which has the beginning in the output voltage of a power converter further again -- it is made to go up greatly, and after that, since it has the electrical-potential-difference command pattern which makes a changed part small, even if it faces the big load effects at the time of starting etc., sag is prevented, a load can be started smoothly and a power control unit with little voltage variation can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the control-block Fig. showing the gestalt 1 of implementation of this invention.
[Drawing 2] It is the control-block Fig. showing the gestalt 2 of implementation of this invention.
[Drawing 3] It is the control-block Fig. showing the gestalt 3 of implementation of this invention.
[Drawing 4] It is the control-block Fig. showing the gestalt 4 of implementation of this invention.
[Drawing 5] It is the control-block Fig. showing the armature-voltage control equipment of the conventional power converter.
[Description of Notations]
1 AC Power Supply, 2 Power Converter, 3 Reactor, 4 Capacitor, 5 An inverter circuit, 6 An induction motor, 7 An electrical-potential-difference detector, 8 Current detector, 9 Electrical-potential-difference setter, 10a-10c An adder subtracter, 11 Armature-voltage control machine, 12 A current limiter, 13 A gate control machine, 14 A current detector, 15 A load compensation machine, 16 A synchronous motor, 17 An external signal, 18-21 An electrical-potential-difference command pattern output means, 18a-21a Electrical-potential-difference command pattern.

[Translation done.]

* NOTICES *

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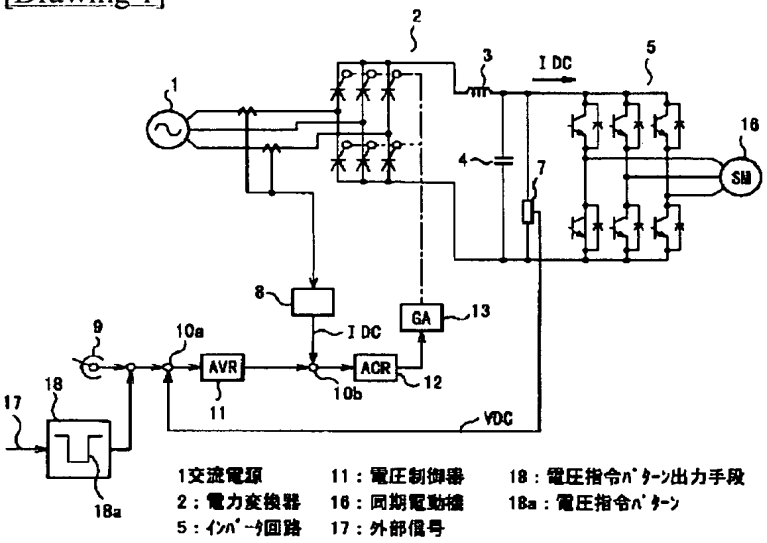
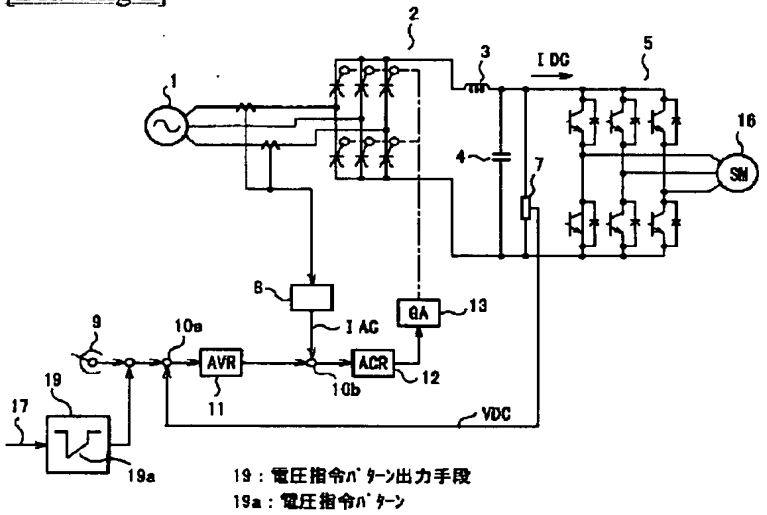
DRAWINGS

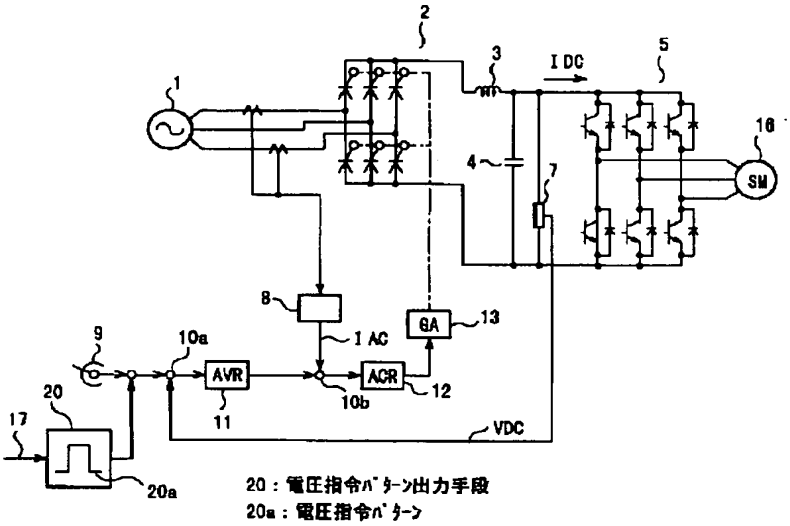
[Drawing 1]



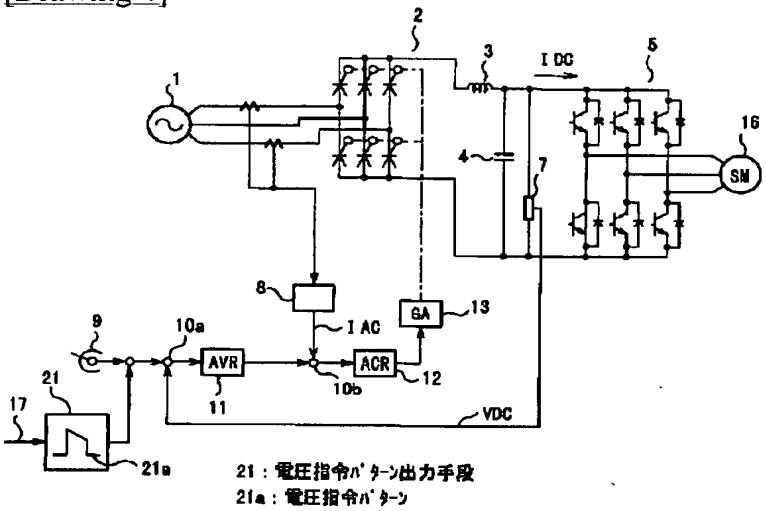
[Drawing 2]



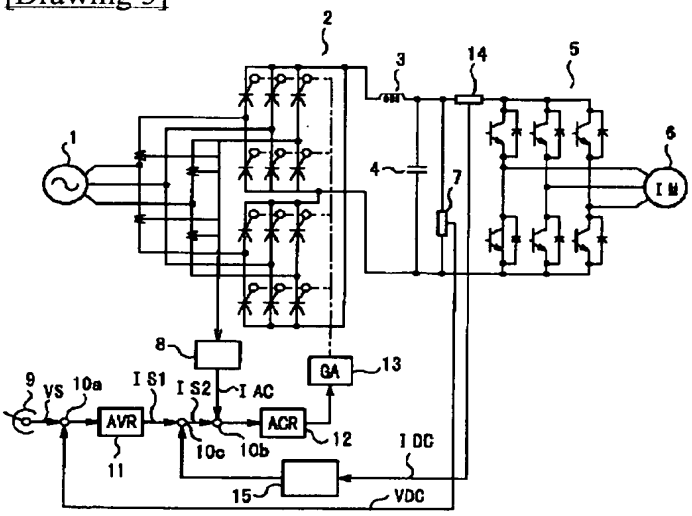
[Drawing 3]



[Drawing 4]



[Drawing 5]



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